

Survey, L. W.

Entomology Research Branch
P. O. Box 232, Kerrville, Texas

June 17, 1955

To: A. W. Lindquist, Head, Section of Insects Affecting
Man and Animals

From: R. C. Bushland, Kerrville, Texas

Subject: Screw-worm Overwintering

You will remember that last year Mr. Bottimer made some studies in an attempt to correlate weather records with screw-worm survival in the Southeastern States. His work on the survey took up most of his time and he was unable to complete his study before his retirement. He has recently worked further with the weather data and overwintering records and prepared a report, which is enclosed.

After you finish with this report would you please refer it to Dr. Knipling if he can spare the time to study the data. It is rather disturbing that Mr. Bottimer was unable to make the conclusions for 1950-51 fit the data for 1953-54 but found that there was about a 10-degree difference in the critical temperature between those winters. Certainly, cold weather is the limiting factor so far as screw-worm winter survival is concerned, but it is not a simple matter of fitting overwintering lines to match isotherms based on minimum or average temperatures for 3- or 5-month periods.

Perhaps you can consult with some weather experts in Washington for leads on correlations to study. Since it seems that interpretations cannot be made on the basis of ordinary arithmetic, it might also be worth while to solicit the aid of the Biometrical Service.

Since we have no other copies of the enclosed material, would you please return it to Kerrville when you have finished.

Entomology Research Branch
P. O. Box 332, Kerrville, Texas

June 17, 1955

To: A. W. Landquist, Head, Section of Insects Affecting
Man and Animals

From: R. C. Bushland, Kerrville, Texas

Subject: Snow-worm Overwintering

You will remember that last year Mr. Bottimer made some studies in an attempt to correlate weather records with snow-worm survival in the Southern States. His work on the survey took up most of his time and he was unable to complete his study before his retirement. He has recently worked further with the weather data and overwintering records and prepared a report, which is enclosed.

After you finish with this report would you please refer it to Dr. Hapling if he can spare the time to study the data. It is rather disturbing that Mr. Bottimer was unable to make the conclusions for 1950-51 fit the data for 1952-54 but found that there was about a 10-degree difference in the critical temperatures between those winters. Certainly, cold weather is the limiting factor so far as snow-worm winter survival is concerned, but it is not a simple matter of fitting overwintering lines to match isotherms based on minimum or average temperatures for 3- or 5-month periods.

Perhaps you can consult with some weather experts in Washington for leads on correlations to study. Since it seems that interpretations cannot be made on the basis of ordinary arithmetic, it might also be worth while to solicit the aid of the Climatological Service.

Since we have no other copies of the enclosed material, would you please return it to Kerrville when you have finished.

Preliminary Report on an Attempt to Associate
Official Weather Records with Survival of the
Screw-worm in the Florida-Georgia Area.

L. J. Bottimer

Due in part to the curtailment of the screw-worm surveys, it was suggested that there be started a study of the relation of the northern limits of the overwintering area of the Florida population with published weather records for that particular area.

Results of surveys during the past 11 years are recorded on maps, the approximate northern limit of survival for each year being shown as a broken line from the Gulf of Mexico to the Atlantic Ocean. In seven of these eleven maps on hand this line is located across northern Florida, usually from Taylor County on the west to Duval County on the east. In three cases the overwintering area includes the southern third or more of Georgia, and in two of these, small areas of both Alabama and South Carolina are included. The unusually cold winter of 1950-51 resulted in the overwintering line being drawn across Central Florida from Hillsborough to Brevard Counties.

Weather data were obtained from the readily available U. S. Department of Commerce, Weather Bureau publication "Climatological Data," a monthly record for each state. Much data pertaining to daily precipitation and temperatures for numerous weather stations are included in this publication. Since temperature is perhaps the most important factor in screw-worm survival, certain averages in temperatures were used in starting the present study.

For many stations the publication gives the daily maximum and the daily minimum temperatures with the average of each for the month. The "average" temperature was obtained by adding the averages of the month's maximum and minimum temperatures together and dividing by two.

Records for the winter of 1950-51 were used first because of the unusual location of the overwintering line in Central Florida. The procedure was to first trace from a map of appropriate size onto several sheets of letter-size paper an outline of Central Florida between the approximate latitudes of Cedar Key on the north and Punta Gorda on the south. Dots showing locations of the various weather stations within this area were then spotted in.

The average temperature and the average minimum temperature for each of the months November 1950 to March 1951, inclusive, were tabulated for each of the weather stations included on the map. Figures for the December-February period were duplicated in separate columns. The following table with temperatures for the Lake Alfred Experiment Station shows the procedure followed for each weather station concerned.

Preliminary Report on an Attempt to Associate
Official Weather Records with Survival of the
Saw-worm in the Florida-Georgia Area.

L. J. Bostinger

Due in part to the curtailment of the saw-worm surveys, it was suggested that there be started a study of the relation of the northern limits of the overwintering area of the Florida population with published weather records for that particular area.

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Records for the winter of 1950-51 were used first because of the unusual location of the overwintering line in Central Florida. The procedure was to first trace from a map of appropriate scale onto several sheets of letter-size paper an outline of Central Florida between the approximate latitudes of Cedar Key on the north and Punta Gorda on the south. Note showing locations of the various weather stations within this area were then spotted in.

The average temperature and the average minimum temperature for each of the months November 1950 to March 1951, inclusive, were tabulated for each of the weather stations included on the map. Figures for the December-February period were duplicated in separate columns. The following table with temperatures for the Lake Alfred Experiment Station shows the procedure followed for each weather station concerned.

	Average		Average Minimum	
	A	B	C	D
Nov. 1950		63.3		49.7
Dec.	58.2	58.2	45.4	45.4
Jan. 1951	60.3	60.3	46.5	46.5
Feb.	60.8	60.8	46.4	46.4
Mar.		67.0		55.0
Total	179.3	309.6	138.3	243.0
Average	59.8	61.9	46.1	48.6

In the above table 59.8 represents the average of 3 months' average temperatures, and 61.9 the average for the 5-month period. In column C 46.1 is the average of 3 months' average minimum temperatures, and in D 48.6 the average for the longer period.

For use on the maps the averages on the last line of the above table were noted above the dot showing the Lake Alfred location, the figure in column A being placed on map A, B on B, etc. When this was completed for all the weather stations on the four maps required, isotherms were established. These lines represent the probable latitude in which average temperatures could be recorded in whole numbers, as 60.0, or 61.0.

The overwintering line on the available map for the 1950-51 winter runs roughly from near Tampa to just north of Melbourne. Comparing this map with maps A and B, it will be seen that the isotherm representing 60 degrees in A crosses the state irregularly in the general vicinity of the limits of overwintering, and that in B the isotherm representing 62 degrees lies in a similar location. Isotherms for the average minimum temperatures in maps C and D all tend to curve abruptly to the south in the central part of the state, indicating no association whatever with the recorded overwintering line.

Two outline maps of southern Georgia showing locations of weather stations were also prepared, average temperatures and average minimum temperatures for the 3-month winter of 1953-54 being recorded near their respective stations. (March 1954 weather records not available.) Isotherms on both of these maps (E and F) as drawn tend to run from the Atlantic Coast in a southwesterly direction, especially in the eastern part of the state. The overwintering area as determined for this particular winter includes the southern third of Georgia from Glynn County on the east to Early County on the west. The irregular line marking the northern limit of survival curves northward slightly between these two counties. In eastern Georgia, the overwintering line crosses several of the isotherms on the maps at nearly right angles, but in the western part of the state the line conceivably

	Average		Average Minimum	
	A	B	C	D
Nov. 1950	62.2	62.2	48.4	48.7
Dec.	62.2	62.2	48.4	48.4
Jan. 1951	60.2	60.2	48.3	48.3
Feb.	60.8	60.8	48.4	48.4
Mar.	67.0	67.0		68.0
Total	170.8	208.8	188.3	243.0
Average	62.8	61.8	48.1	48.6

In the above table 62.8 represents the average of 3 months' average temperatures, and 61.8 the average for the 5-month period. In column C 48.1 is the average of 3 months' average minimum temperatures, and in D 48.6 the average for the longer period.

For use on the maps the averages on the last line of the above table were noted above the dot showing the Lake Alfred location, the figure in column A being placed on map A, B on B, etc. When this was completed for all the weather stations on the four maps required, isotherms were established. These lines represent the probable latitude in which average temperatures could be recorded in whole numbers, as 60.0, or 61.0.

The overwintering line on the available map for the 1950-51 winter runs roughly from near Tampa to just north of Melbourne. Comparing this map with maps A and B, it will be seen that the isotherm representing 60 degrees in A crosses the state irregularly in the general vicinity of the limits of overwintering, and that in B the isotherm representing 62 degrees lies in a similar location. Isotherms for the average minimum temperatures in maps C and D all tend to curve sharply to the south in the central part of the state, indicating no association whatever with the recorded overwintering line.

Two outline maps of southern Georgia showing locations of weather stations were also prepared, average temperatures and average minimum temperatures for the 3-month winter of 1953-54 being recorded near their respective stations. (March 1954 weather records not available.) Isotherms on both of these maps (E and F) as drawn tend to run from the Atlantic Coast in a southwesterly direction, especially in the eastern part of the state. The overwintering area as determined for this particular winter includes the southern third of Georgia from Glynn County on the east to Early County on the west. The irregular line marking the northern limit of survival curves northward slightly between these two counties. In eastern Georgia, the overwintering line crosses several of the isotherms on the maps at nearly right angles, but in the western part of the state the line consecutively

follows the general direction of the isotherms. It should be noted that the temperatures concerned in this part of Georgia are in the low 50's for the average (map E) and in the low 40's for the average minimum (map F).

For a comparison of winter (December-February) weather conditions for the two seasons in question, 1950-51 and 1953-54, map A should be directly compared with map E, and C with F. In A the survival line would run thru localities having an average temperature of 59-60 degrees, while in E the northern limit of survival was determined thru localities having an average temperature of roughly 52-56 degrees. Since the temperatures recorded on these maps are based on official records and their localities fairly accurate, either the average temperature has no bearing on screw-worm survival or the limit of survival for one of the years is inaccurate. Should the survival line of 1950-51, with its 59-60 degree temperature, be considered accurate, examination of map E would show that similar temperatures for the 1953-54 winter would be found only in Florida and considerably below the Georgia line. Positive screw-worm cases were noted in extreme northern Florida and in southern Georgia during that winter. If, on the other hand, the average temperature ranging between 52 and 56 degrees are considered more nearly accurate, an examination of map A would show that these temperatures are to be found only as far south as extreme northern Florida. It is quite generally conceded that the screw-worm failed to survive in the northern half of Florida during the 1950-51 winter.

Data on maps C and F, based on average minimum temperatures, show similar discrepancies regarding the location of the overwintering lines. In the Florida area, minimum temperatures of approximately 47 to 51 degrees are involved, while those in Georgia are mostly in the low 40's.

Temperature records for the 5-month winter of 1953-54 in Georgia were not completed, since the March issue of Climatological Data had not been received

Conclusions: Even though a very limited time was available for this study, certain conclusions are indicated. Since surveys have been based almost entirely upon unverified reports from ranchers, county agents, veterinarians, druggists, retailers, and other informants, it is most likely that many of our records pertained to secondary larvae rather than to Callitroga hominivorax. Assuming the survival lines as established for the two winters concerned to be fairly accurate, there appears to be no relationship between either the 3-month winter average temperatures or the 3-month average minimum temperatures of the two winters. The 5-month winter records could be expected to show more variation. In theory, minimum temperatures should have a direct bearing on survival. Available data give in some cases the lowest temperature reached on any given date for a weather station, but no study of these lows was made. Average mean temperatures as reported by Parman, 1945 (Jour. Econ. Ent. 38(1): 66-76) may prove to be more usable.

June 1954

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For a comparison of winter (December-February) weather conditions for the two seasons in question, 1950-51 and 1953-54, map A should be directly compared with map E, and C with F. In A the survival line would run thru localities having an average temperature of 55-60 degrees, while in E the northern limit of survival was determined thru localities having an average temperature of roughly 52-55 degrees. Since the temperatures recorded on these maps are based on official records and their localities fairly accurate, either the average temperature has no bearing on snow-worm survival or the limit of survival for one of the years is inaccurate. Should the survival line of 1950-51, with its 53-60 degree temperature, be considered accurate, examination of map E would show that similar temperatures for the 1953-54 winter would be found only in Florida and considerably below the Georgia line. Positive snow-worm cases were noted in extreme northern Florida and in southern Georgia during that winter. If, on the other hand, the average temperature ranging between 52 and 55 degrees are considered more nearly accurate, an examination of map A would show that these temperatures are to be found only as far south as extreme northern Florida. It is quite generally conceded that the snow-worm failed to survive in the northern half of Florida during the 1950-51 winter.

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June 1951